

Southeast Arizona Regional Transportation Profile Study

Nogales Railroad Assessment Study

April 2005

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I. INTRODUCTION

At the January 2005 meeting of the Railroad Issues Committee of the Greater Nogales and Santa Cruz County Port Authority, consensus was reached by the Committee on the need to prepare a White Paper to document the impacts of international freight rail operations on traffic and pedestrian flow within the City of Nogales, Arizona and to identify a “toolbox” of strategies to mitigate documented impacts. A foundation for the White Paper was recognition that relocation of the railroad was not a realistic short-term goal for alleviating rail operation impacts and that strategies for mitigating impacts should assume that the railroad will remain on its current alignment. This premise was further supported by capital infrastructure investments in Nogales, Sonora to mitigate rail operation impacts with improvements such as constructing railroad overpasses (grade-separations) to improve vehicular and pedestrian flow.

The purpose of this report is to provide technical input to the White Paper to be prepared by the Port Authority. This report was prepared in partial fulfillment of the Southeast Arizona Regional Transportation Profile, Task 2: Existing and Future Conditions Analysis, which is funded and administered by the Arizona Department of Transportation (ADOT) Transportation Planning Division.

BACKGROUND

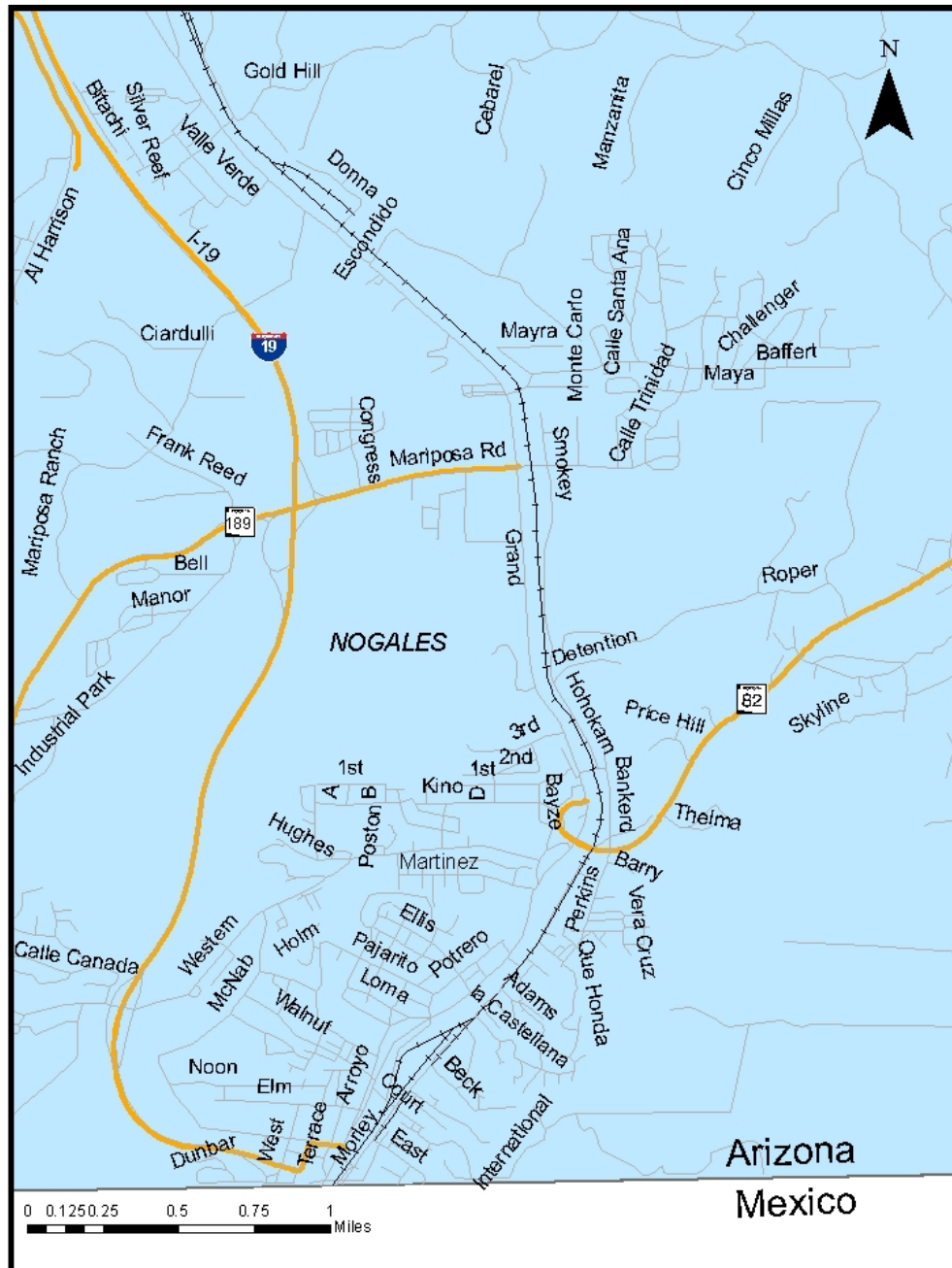
For more than twenty years, freight rail operations in the downtown areas of both (ambos) Nogales Arizona and Sonora has received binational attention from the public, local elected officials, business owners, and federal agencies operating at the international port of entry. Northbound and southbound trains in the downtown areas disrupt local vehicular and pedestrian traffic circulation, international vehicular and pedestrian traffic flow, emergency services, and local commerce. Over the years, a number of actions have been taken to mitigate the adverse impacts of rail operations in the downtown area including better communications between US and Mexican inspection agencies and rail personnel, installation of advanced inspection technologies, and relocation of rail inspection facilities to Rio Rico, Arizona (away from downtown areas).



Two railroad companies operate on the single set of railroad tracks through the Nogales international port of entry, the Union Pacific Railroad and Ferrocarril Mexicano (Ferromex). On a typical weekday, four trains are processed through the international port of entry, each pulling an average of 100 container cars (two northbound and two southbound trains). Northbound freight rail shipments are subject to inspections by US Customs and Border Protection and southbound freight rail shipments are subject to inspections by the Aduanas de Sonora. In Nogales, Arizona, the railroad tracks are located

between Grand Avenue (Business Route 19) and Morley Avenue within the central Nogales business district. **Exhibit 1** shows the location of the railroad within the Nogales urban area.

EXHIBIT 1 – STUDY AREA MAP





View of State Route 82 Railroad Overpass

Within the City of Nogales, Arizona, all of the rail crossings in are at-grade with the local street system with the exception of a grade-separated (overpass) crossing of State Route 82, shown in the picture at the left. In fact, this crossing is the only grade-separated crossing of the railroad in Nogales and Santa Cruz County. There are nine at-grade crossings of the railroad throughout the City of Nogales, Arizona.

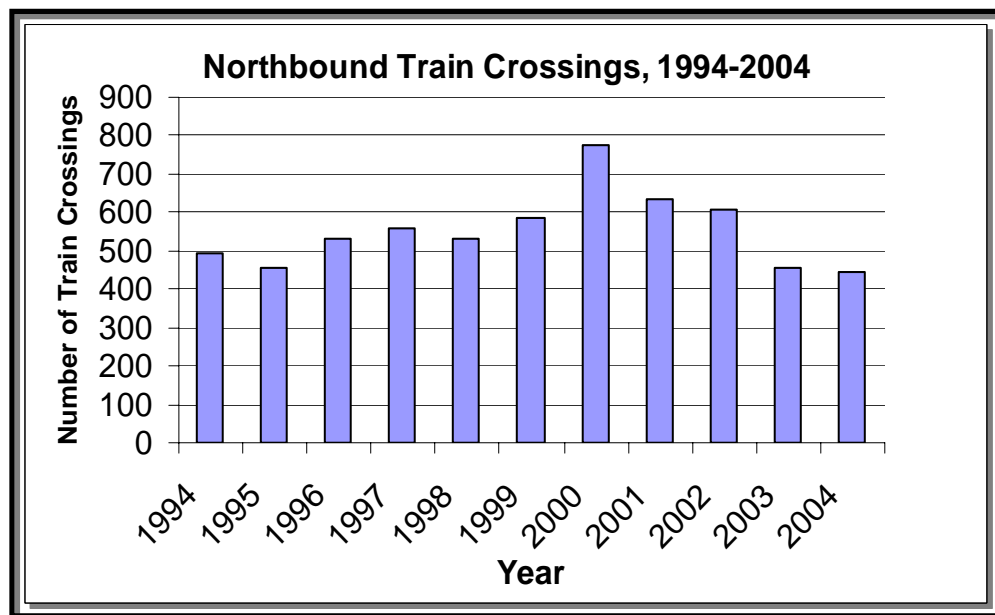
2. HISTORIC AND FUTURE FREIGHT RAIL ACTIVITY AT THE DECONCINI PORT OF ENTRY

HISTORIC FREIGHT RAIL ACTIVITY

According to the *Nogales CyberPort Project Commodity Flow Study* (2003) prepared by the University of Arizona, with the exception of Laredo, Texas, no other US-Mexico port processes more tons of northbound trade by rail than Nogales. According to the *Study*, the length of trains through Nogales has nearly doubled over the last five years and the port is processing a greater percentage of full rail containers. In terms of moving tons of trade relative to existing infrastructure and other ports of entry, the *Commodity Flow Study* rated the productivity of the Nogales port as high.

Exhibit 2 shows the number of northbound train crossings per year through the Nogales port of entry between 1994 and 2004. In the 10 year period, the number of northbound train crossings peaked in 2000, when there were 774 northbound train crossings in that year. Since 2000, train crossings have decreased. In 2004, there were 444 northbound train crossings, representing a 43 percent decrease in number of trains from the peak year of 2000.

EXHIBIT 2 - ANNUAL NORTHBOUND TRAIN CROSSING AT THE NOGALES PORT

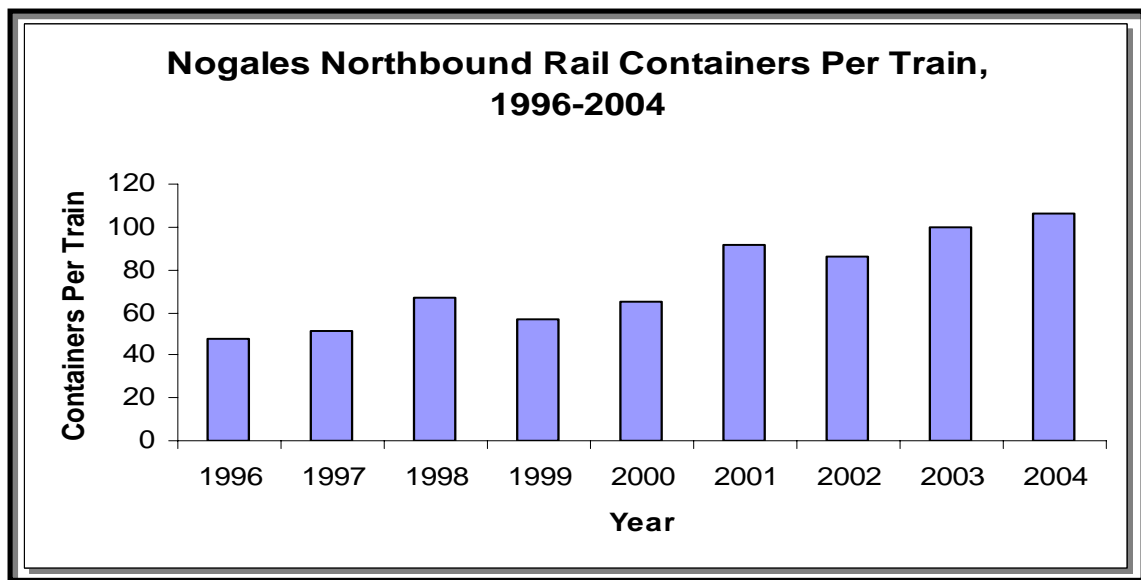


Source: Nogales CyberPort Project Commodity Flow Study (2003) and United States Customs and Border Protection (Tucson Field Operations)

The number of rail containers per train, between 1996 and 2004 is shown in **Exhibit 3**. Statistics were available for the northbound direction only. In this time period, the average number of rail containers per train grew from 48 to 106 containers per train, representing approximately a 120 percent increase in the number of containers per train since 1996.

In the time period from 2000 to 2004, although the total number of trains has decreased, each is carrying a larger number of containers per train.

EXHIBIT 3 - ANNUAL NORTHBOUND RAIL CONTAINERS PER TRAIN



Source: Nogales CyberPort Project Commodity Flow Study (2003) and United States Customs and Border Protection (Tucson Field Operations)

Commodities Shipped By Rail

The top commodities shipped by rail in 2004, ranked by dollar value shipped through the Nogales port of entry are summarized in **Exhibit 4**. By value, automobiles were the most valuable commodity shipped, and as is discussed later in this report, automobile shipments are expected to increase significantly in the future. By value, the next top five commodities in addition to automobiles were beer, copper cathodes, Portland cement, and copper ore.

**EXHIBIT 4 - COMMODITIES SHIPPED BY RAIL THROUGH THE NOGALES PORT
BY VALUE (2004)**

Rank	Description	Value	Percentage of Total Imports
1	Automobiles	\$746,383,963	75.21%
2	Beer	\$75,071,284	7.56%
3	Copper Cathodes	\$56,255,783	5.67%
4	Portland Cement	\$25,270,058	2.55%
5	Copper Ore	\$23,776,786	2.40%
6	Copper Wire	\$17,177,247	1.73%
7	Auto Body Parts	\$9,954,692	1.00%
8	Safflower Oil	\$8,711,344	0.88%
9	Prepared Vegetables	\$7,265,706	0.73%
10	Sulfuric Acid	\$3,810,876	0.38%
11	Fish Meal	\$3,676,036	0.37%
12	Tomato Paste	\$3,223,128	0.32%
13	Prepared Fruits	\$2,293,385	0.23%
14	Prepared Pimientos	\$1,628,033	0.16%
15	American Goods Returned	\$1,292,579	0.13%
16	Other Minerals	\$977,976	0.10%
17	Graphite Powder	\$934,168	0.09%
18	Shelled Beans	\$917,819	0.09%
19	Sauces	\$697,476	0.07%
20	Fish Oils	\$589,006	0.06%
	All other tariffs	\$2,506,924	0.25%
	Total	\$992,414,269	100.00%

Source: United States Customs and Border Protection (Tucson Field Operations)

Hazardous Materials

According to the *Nogales CyberPort Project Commodity Flow Study* (2003), nearly 370,000 tons of northbound sulfuric acid was processed through the Nogales port of entry by rail in 2002. Sulfuric acid accounts for over 99 percent of all northbound hazardous materials by weight. Sulfuric acid accounts for over 99 percent of all northbound hazardous materials by weight. As shown in **Exhibit 4**, in 2004 sulfuric acid was the 10th most valuable commodity shipped into the US.

Southbound, approximately 125,000 tons of hazardous materials were transported by rail, primarily consisting of coal, fertilizers, and phosphoric acid.

The Customs and Border Patrol (CBP) has a hazardous material coordinator and a plan for spills, which is coordinated with the plans established by the City of Nogales and Santa Cruz County. The CBP notifies the City of Nogales Police and Fire Department in case of a hazardous materials incident. Discussions with Nogales Police Department staff indicated that in case of a hazardous material incident, the police force serves to set up perimeter boundaries to safeguard the public and the Nogales Fire Department addresses the actual cleanup of the contaminant.

FUTURE FREIGHT RAIL ACTIVITIES

According to the *Nogales CyberPort Project Executive Report* (2003), the range of potential market share for surface trade at the Arizona-Sonora border ports of entry, which can be indicative of the potential for future growth, is summarized in **Exhibit 5**.

EXHIBIT 5 - POTENTIAL MARKET CAPTURE OF US-MEXICO SURFACE TRADE FOR ARIZONA-SONORA BORDER PORTS OF ENTRY, 2000

	Low Market Capture Percentage	High Market Capture Percentage	Actual Market Capture Percentage
Northbound Trade	4.3%	22.7%	13.1%
Southbound Trade	4.8%	15.7%	5.5%

Source: Nogales CyberPort *Project Executive Report* (2003), p.41

As Exhibit 5 indicates, actual northbound trade capture for the year 2000 is in the middle of the range, indicating there is potential for more market capture of imports. Southbound market capture is at the lower end of the range, indicating that there is even more potential for increased exports to Mexico.

Ford Motor Company Shipments

Information obtained from Ford Motor Company indicated that there will be increased exports of automobiles from Mexico to the US, and increased shipments from the US to Mexico of raw materials for vehicle production. The 2006 Ford Fusion, a mid-size sedan, will be built at the Hermosillo Stamping and Assembly Plant in Sonora, Mexico, beginning in August 2005. The Fusion is the first iteration of a vehicle platform that will form the basis for up to 10 new products and 800,000 units across the Ford, Lincoln and Mercury brands in the next several years. Total program investment, including development, will be in the range of \$1 billion, according to an article in *Automotive Intelligence News* (October 8, 2003). To prepare for the Fusion, the plant will install Ford's new flexible manufacturing system, allowing it to change products and options more quickly to better meet market demand.

Currently, Ford Motor Company ships approximately 20 rail cars per day, on one train which would typically leave Hermosillo at 5 AM each day. When the new production starts in August 2005, it is anticipated that the shipments will increase to between 70 to 80 cars per day (on one train), and will increase even further during the peak production periods of November to December, 2005, when it is anticipated that 70-80 cars per day will be shipped to the United States from the Hermosillo plant. Incoming shipments of raw materials are also expected to increase, and are typically shipped by rail during the night.

Discussion with the Union Pacific Railroad indicated that they anticipate that there will be an increase of one train in each direction through Ambos Nogales to accommodate increased shipments from the Ford Motor Company expansion. In order to minimize delays, the Union Pacific Railroad will be extending the railroad siding at Rio Rico, and constructing a new siding at Sahuarita so that trains will be able to pass at these points on the otherwise single track.

Puerto Nuevo

The increase of intermodal shipping centers will have a positive impact on rail trade, by providing a multi-dimensional inland port and direct access to the Union Pacific mainline at the Port of Tucson's rail/truck transfer station. The proposed Puerto Nuevo project area is located in Century Park, the current location of the Port of Tucson. According to the *Mariposa Port of Entry Economic Study* (2005), conducted by BPLW Architects and Engineers, "If successful, the Puerto Nuevo project might...ultimately increase traffic at (through Nogales) as a result of the increased border activity and economic growth across the State of Arizona as well as Sonora, Mexico."

3. RAILROAD OPERATIONS IN THE CITY OF NOGALES, ARIZONA

DESCRIPTION OF RAIL CROSSINGS

Within the City of Nogales, Arizona, there are 9 at-grade rail crossings. The type of control at each at-grade crossing is summarized in **Exhibit 6**. During a typical weekday there are 2 trains per day in each direction, according to representatives of the Union Pacific Railroad Police Department, and US Customs and Border Protection. The train schedules can and do vary from day to day.

EXHIBIT 6 - NOGALES, ARIZONA AT-GRADE RAILROAD CROSSING LOCATIONS AND CONTROL

Location	Type of Control
Park Street	Gates and Flashers
Court Street	Gates and Flashers
Banks Bridge	Gates and Flashers
Doe Street	Gates and Flashers
C. Sonora	Gates and Flashers
Baffert Drive	Gates and Flashers
Escondido Drive	Crossbucks
Produce Row	Gates and Flashers
Goldhill Road	Gates and Flashers

Source: Arizona Department of Transportation

On northbound Grand Avenue, there is an advance warning signal and flasher for the Doe Street railroad crossing to improve sight distance and safety.

CRASH DATA

Three years of railroad crossing related vehicle crash data in the Nogales area was obtained from the Arizona Department of Transportation, State Railroad Inventory and are summarized in **Exhibit 7**. The crashes of record in the City were all railroad-related, but did not involve any actual train collisions. Of the five crashes occurring at railroad crossings within



the city limits, one was an injury accident and none were fatal accidents.

**EXHIBIT 7 – 2001-2004 CRASH DATA FOR NOGALES
AT-GRADE RAILROAD CROSSINGS**

Rail Crossing Number	Location	Type of Control	Number of Crashes	Number of Injury Crashes	Number of Fatalities
742-042-K	Park Street	Gates and Flashers	0	0	0
742-041-D	Court Street	Gates and Flashers	0	0	0
742-040-W	Banks Bridge	Gates and Flashers	0	0	0
742-038-V	Doe Street	Gates and Flashers	0	0	0
742-037-N	C. Sonora	Gates and Flashers	2	1	0
742-036-G	Baffert Drive	Gates and Flashers	1	0	0
742-035-A	Escondido Drive	Crossbucks	0	0	0
742-034-T	Produce Row	Gates and Flashers	1	0	0
742-032-E	Goldhill Road	Gates and Flashers	2	0	0
Total			5	1	0

Source: Arizona Department of Transportation State Railroad Inventory

Emergency Services

The City of Nogales Police Department and Fire Station are both located on Grand Avenue, on the west side of the railroad tracks. In order to respond to an emergency call east of the railroad tracks while a train is traveling through town, the emergency responders must either detour north and use SR 82, the only grade-separated crossing, or estimate the location of the train, and choose an at-grade crossing that is judged to be clear. If a person must be transported to the hospital, the Carondelet Holy Cross Hospital is located on Target Range Road, west of the Interstate 19, and west of the railroad tracks. This may require another potential detour if the train occupies the at-grade crossings. The Nogales Police Department has more flexibility in routing emergency services because patrol cars are at various locations in the City at any given time.

The Santa Cruz County Sheriffs Department is located on Hohokam Drive, east of the railroad tracks. Similarly, trips to the west side of the tracks and to the hospital may potentially require a detour.

Depending on the train schedule, and the specific location of the emergency service personnel, there is a potential for delayed response times to an accident, fire, or other emergency due to the train blocking access.

Other Safety Considerations

A safety implication of freight transport through the Nogales area is the potential impact of incidents involving the shipment of hazardous materials through the populated area of Nogales, Arizona. The volume of commodities within hazardous materials classifications has increased by over 34 percent between 2000 and 2001, due primarily to increases in sulfuric acid transport. Potential problems may occur should a train derailment or other incident occur. As discussed previously, procedures for addressing hazardous materials spills are defined in plans for the City of Nogales, Santa Cruz County, and the Customs and Border Protection.

4. RAIL FREIGHT PROCESSING PROCEDURES

US Customs and Border Protection (CBP) is the unified border agency within the Department of Homeland Security (DHS) that is responsible for inspecting northbound rail traffic at the DeConcini Port of Entry. The CBP inspection process for freight rail cars is described below.

NORTHBOUND RAIL FREIGHT PROCESSING

When a northbound train prepares to enter the United States, the Ferromex crew is replaced by a Union Pacific crew, which notifies US Custom Service of its arrival.

The border gate is then opened and the train pulls through. Immediately north of the international border, a Vehicle and Cargo Inspection System (VACIS), installed in 2002, x-rays the rail cars as part of the primary inspection process. Typically, trains pass through the VACIS at 5-7 mph and continue on to the Rio Rico secondary inspection facility where CBP and the US Border Patrol conduct secondary inspections, if required.



**Rail Border Crossing Area at DeConcini Port of Entry at
Nogales Arizona**

The Rio Rico inspection area is located near the frontage road of I-19 north of the Ruby Road traffic interchange. A view of the inspection area is shown below.



*Southeast Arizona Regional Transportation Profile
Nogales Railroad Assessment Study*

View of Rail Inspection Area near Rio Rico, Arizona

SOUTHBOUND RAIL FREIGHT PROCESSING

The Aduanas de Sonora is responsible for inspecting southbound trains into Mexico. When a train prepares to enter Mexico, the Union Pacific crew is exchanged with the Ferromex crew and the crew notifies the Aduanas de Sonora of its arrival, and the train is processed.

5. VEHICLE AND PEDESTRIAN OVERPASS CONSTRUCTION IN NOGALES, SONORA

A program funded by Federal, State, and local Mexican agencies and Ferromex is underway to construct railroad overpasses (grade-separations) for vehicles and pedestrians in Nogales, Sonora. The program consists of constructing four vehicle-railroad overpasses at a construction cost of approximately \$11.0 million and nine pedestrian bridges with elevators to assist handicapped pedestrians at a cost of \$1.4 million. Construction of the first vehicle-railroad overpass structure located at the corner of Calle Alvaro Obregon and Boulevard El Greco is scheduled for completion in May, 2005.

Other vehicle-railroad overpasses will be constructed over the next two years at the following locations:

- Ana Gabriela Guevara
- Segura Social
- Buenos Aires Road / Heroes Road

The vehicle-railroad overpasses at Buenos Aires Road and Heroes Road is located less than four blocks from the international port of entry.

Information on locations and construction schedules for the pedestrian overpasses was not available.



6. SUMMARY OF RAIL ISSUES AND MITIGATION MEASURES

From the analysis of rail operations and freight processing at the port of entry, this study has identified a number of issues worthy of further analysis and resolution. This chapter summarizes these issues and identifies a “toolbox” of potential mitigation measures and associated planning level cost estimates to address each issue. Issues and mitigation measures assume that the rail road will not be relocated from its current alignment.

NEED FOR IMPROVED VEHICULAR ACCESS

Within Nogales, the railroad tracks run in close proximity to two major north /south routes, Grand Avenue and Morley Avenue. Delays to cross street traffic have increased as a result of longer trains, and more frequent train activity is projected to occur in the near future due to expanded imports of automobiles, and exports of automobile production materials. Drivers and emergency service providers do not have advance knowledge of the train schedules, and cannot plan route detours in advance.

TOOLBOX STRATEGIES TO ADDRESS VEHICULAR ACCESS

Grade Separations

Construction of grade-separated rail crossings in the downtown area would improve east-west connectivity. In the area south of SR 82, a preliminary review indicated that opportunities are limited for grade-separations, because of right-of-way impacts and disruption to existing businesses. However, locations further north, such as Mariposa Road, appear to have more potential because there is wider right-of-way available for future construction. The *Unified Nogales/Santa Cruz County Transportation 2000 Study* recommends widening Mariposa Road to an ultimate 6-lane cross section between Grand Avenue and Frank Reed Road by 2020. This project presents an opportunity to consider a railroad grade-separation north of SR 82. Other opportunities may exist north of Mariposa Road.

A first step in planning additional railroad grade-separations includes conducting an engineering feasibility study to identify potential locations for one or more grade-separated crossings. The study should address roadway improvement plans contained in the *Unified Nogales/Santa Cruz County Transportation 2000 Study*, ownership of right-of-way in the vicinity of the railroad tracks. The City of Nogales may have prior rights near the tracks, or the ownership may be controlled by the Union Pacific Railroad.

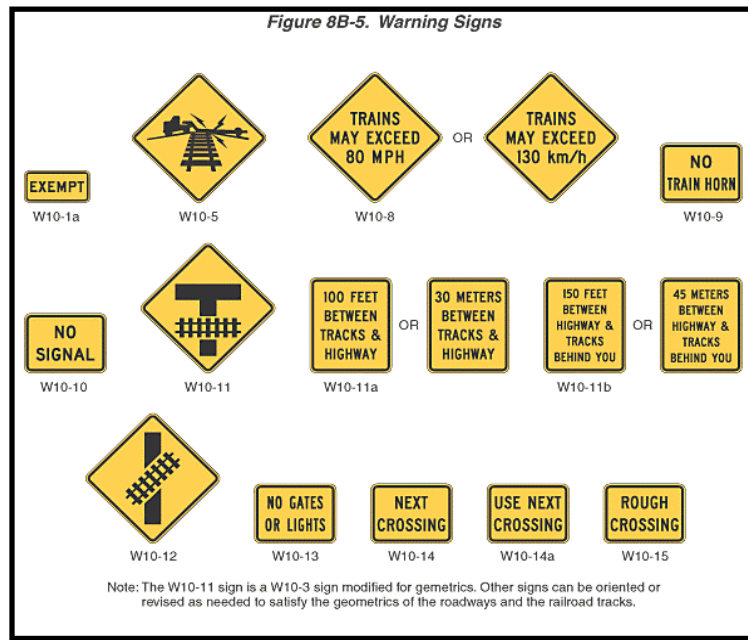
Components of an engineering feasibility study would include a location analysis, an assessment of the right of way needed to meet engineering design criteria, preliminary design, cost estimates, and assessment of other potential impacts.

Estimated Cost of grade-separated overpass: \$6-\$10 million

Estimated Cost of Engineering Feasibility Study: \$300,000

Traffic Control Device Improvements

Improvements to signing, striping and traffic control would improve operations and safety at existing rail crossings in the Nogales area, and minimize the possibility of drivers stopping on the tracks. Examples include installation of additional warning signs and “pre-signals” on the crossroads.



An engineering feasibility study is needed to determine a set of specific improvements at each at-grade crossing, prioritize the improvements, and develop a set of specific projects for funding.

Estimated Cost: \$100,000

ITS Technologies

Dynamic message signs provide advance warning of train activity and give extra time to drivers and emergency service providers to reroute their trip to minimize delays. The signs could be activated through automatic sensors on the tracks, or through dial-in capability.

Examples of Warning Signs for Railroad Crossings

Estimated Cost: **Ground-Mounted = \$50,000 per sign**
 Overhead-Mounted = \$150,000-200,000 per sign

NEED FOR IMPROVED PEDESTRIAN ACCESS

Within the downtown area the close mix of vehicles, pedestrians, and trains can lead to potential safety problems. An example is shown in the photo at right, taken at Park Street near the port of entry. As mentioned in the previous chapter, a program of pedestrian overpass construction is planned in Nogales Sonora, to address pedestrian access and safety.



**View Looking North from DeConcini
Port of Entry towards Park Street**

TOOLBOX STRATEGIES TO IMPROVE PEDESTRIAN ACCESS

Pedestrian Overpasses

Construction of one or more pedestrian overpasses would separate pedestrians from vehicles and the railroad. Pedestrian overpasses would need to conform to the requirements of the American with Disabilities Act, which has specific requirements for slopes of ramps leading to the overpass. Because of limited right-of-way in the downtown area, elevators may be required to minimize impacts.

An example of a pedestrian overpass in Nogales is the overpass that is part of the DeConcini Port of entry.

An initial first step in the development of a pedestrian overpass would be to conduct an engineering feasibility study to determine the potential locations and costs.

Estimated Cost: **Engineering Feasibility Study: \$50,000**
 Construction cost of one pedestrian overpass: \$ 3 - \$7 million

Public Information Program

This strategy is geared towards educating the public on rail safety. In 1987, the non-profit *Operation Lifesaver* was established at the national level as a public education program designed to reduce the number of crashes, deaths, and injuries at railroad crossings and railroad rights-of-way. Since that time, state programs have also been established. The Arizona branch of *Operation Lifesaver* provides a free public service education program on highway-rail grade crossing safety and gets involved with engineering projects to improve public safety. They also work with the law enforcement community in an effort to reduce grade crossing and trespass incidents. The Nogales Port Authority can work with this group on community out-reach efforts.

Estimated Cost: **Minimal - costs would involve coordination time, and setting up meeting venues**

NEED FOR IMPROVED EMERGENCY SERVICE PROVIDER ACCESS

Discussion with the Nogales Police Department indicated that the location of the railroad can increase emergency response times. If an emergency call comes in while a train is traveling through the City, then the emergency service providers have to assess the location of the train and decide on an appropriate detour route, which may include traveling to State Route 82, or taking an alternate route either north or south of the train. Currently emergency service personnel do not have advance knowledge of the train schedules.

TOOLBOX STRATEGIES TO IMPROVE EMERGENCY SERVICE PROVIDER ACCESS

Duplication of Emergency Services on Both Sides of the Railroad Tracks

Greater accessibility to emergency service providers would be provided by construction of fire and police substations on both sides of the railroad tracks. However, this strategy would not increase the number of grade-separated crossings to the general public, and is not favored by the City of Nogales Police Department.

Estimated Cost: **Not Recommended**

Notification Procedures for Municipal Agencies

This mitigation measure involves development of a system to provide advance rail information to the 911 call center. As emergency calls come through, the 911 operator could alert emergency service providers so they could proactively plan a detour route. This system could be accomplished in a number of ways. A connection could be placed between the train sensors that activate the automatic train gates, and the 911 call center. Alternatively, the Customs and Border Protection Service could communicate to a 911 center when a northbound train is passing, via an automatic phone dialing system.

Cost: **Variable, depending on the specific strategy used**

References

1. Ibarra, Ignacio, *Tie-Ups Loom at the Border*, Arizona Daily Star, December 20, 2004.
2. *Mariposa Port of Entry Economic Study*, BPLW Architects and Engineers, 2005
3. *Nogales CyberPort Project Commodity Flow Study*, University of Arizona Office of Economic Development (prepared for the Governor's CANAMEX Task Force), June 2003
4. *Nogales CyberPort Project Executive Report*, University of Arizona Office of Economic Development (prepared for the Governor's CANAMEX Task Force), June 2003, p.41
5. *Operation Lifesaver Mission Statement*, http://www.oli.org/ol_basics/mission.html
6. *Unified Nogales/Santa Cruz County Transportation 2000 Plan*, Kimley-Horn & Associates, December, 2000.
7. US Department of Transportation, Bureau of Transportation Statistics, *Border Crossing Data*, Surface Freight Data, <http://www.transtats.bts.gov/>

Other References

Personal and telephone interviews were conducted with representatives of the following agencies and organizations:

- US Customs and Border Protection
- Ford Motor Company
- Nogales Police Department
- Union Pacific Railroad Company Police Department
- University of Arizona, Office of Economic Development
- Arizona Department of Transportation, State Railroad Inventory
- Secretaria de Infraestructura Urbana y Ecologia, Sonora, Mexico
- City of Nogales, Arizona
- City of Nogales, Sonora